REMARKS

The examiner rejected claim 101 under section 112 second paragraph because the limitation "said common conductor" lacked antecedent basis. Claim 101 is thus amended to depend from claim 100 instead of claim 96 to provide antecedent basis. Claim 102 is likewise amended to depend from claim 100 instead of claim 96 to provide antecedent basis for the limitation "said common conductor" of claim 103.

The examiner rejected claims 20-74 and 96-113 as unpatentable over Zimmer (U.S. 5,175, 392) in view of Siems. With regard to claim 20, the examiner notes that Siems discloses first and second interfaces 66, 68 each coupled to a memory 60.

As shown in Siems Figures 1-3, transceiver units 12a, 12b, ...12n, each with elemental seismic sensors 24, 24′, 24″, generally correspond to the plurality of sensor pods according to the present invention. The transceiver units 12a, 12b, ...12n are coupled one to another for data transmission by wide band data transmission links 14, 14a, 14b, ... 14n. Referring to Figures 2-3, the output of transmitter 66 (at data link 14 of Figure 2 and 14a of Figure 3) corresponds to the first telemetric communications interface of the present invention, and the input to receiver 68 (at the unlabeled data link of Figure 2 and data link 14b of Figure 3) corresponds to the second telemetric communications interface. The Siems memory element corresponding to the memory of the present invention is the D flip-flop 70. As shown in Siems Figure 3, D flip-flop 70 is operatively coupled to and receives input from receiver 68 via digital logic OR gate 102. The output 107 of D flip-flop 70 is operatively coupled to and provides data to transmitter 66 at digital logic gate 75. D flip-flop 70 is also arranged to receive input from an elemental seismic sensor 24, 24′, 24″ via A/D converter 56, code converter and storage register 58 and digital logic OR gate 102.

Independent claims 20, 96 and 113 are thus amended to add the limitations that the first and second telemetric communication interfaces are bi-directional. The amendments are fully supported by the specification. The Figure 5 schematic diagram clearly shows double arrowheads (functionally designating information flow in both directions) between the communications converters 112, 114 and the upper and lower connectors 42, 44, respectively, and between the communications converters 112, 114 and the processor and RAM memory 120, 28′. Furthermore, in addition to upward information transfer from the pods to the telemetry and control module, the specification discloses using a bucket brigade method to transfer information downwards from the telemetry and control module to the pods. Spec. ¶ 32 ("The telemetry and control module then commands the nearest sensor pod to send its data. This sensor pod then begins sending its data and simultaneously commands the next pod to send its data."); ¶ 33 ("The bucket brigade method allows a high speed data transfer from all of the remote pods to the telemetry and control module *and vice versa*...."); ¶ 46 ("[C]ommunication with a particular pod...is accomplished...by downward bucket brigade method...."). The employment of downward bucket brigade communication and bi-directional telemetric communications interfaces is believed to be novel and unobvious. Neither Zimmer nor Siems discloses or suggests the use of downward bucket brigade or bi-directional telemetric communications interfaces.

Rather, Zimmer teaches that the data in each sensor pod is transmitted by telemetry unit 30 directly to the main surface telemetry receiver 10 along a common bus in a continuous cable passing through the sensor pods. Col. 8 ll. 1-5 ("Depending on the data transfer rate *from the telemetry unit 30 up to the main unit 10*, the M stations can be cleared of data in the several memories 31 so that all that data is written in the memory 25 to leave the memory units 31

cleared of data."). Zimmer is silent as to whether telemetry unit 30 can receive data from surface unit 10.

Siems discloses only uni-directional telemetric communications interfaces. The schematic diagram of Figure 2 shows functional lines with single arrowheads only connecting the receiver 68 and transmitter 66 with data links 14 and memory element 60. The detailed circuit diagram of Figure 3 confirms that data link 14b is coupled only to input circuitry of receiver 68 and data link 14a is coupled only to an output stage of transmitter 66. Siems clearly teaches that downward communications from the surface module occurs by separate link 16.

Independent claims 20, 96 and 113 are also amended to add the limitation that the memory is structured to store more than one bit of information at a time This amendment more particularly claims the subject matter regarded as the invention and is fully supported by the specification. Figure 5 illustrates RAM 28′, which is well known in the art to have capability to store more than one digital bit of information at a time. See also spec. at ¶ 49.

The Siems memory element coupled to the transmitter 66 and receiver 68 (corresponding to the first and second telemetric communication interfaces of the present invention, respectively) is the D flip-flop 70. It is well known in the art that a flip-flop is a memory device that remembers a single binary bit of information. Thus, Siems bucket brigade data transfer method is limited to tiny "buckets" of only one digital bit each passed from device to device. Because the Siems device uses only a single bit flip-flop 70 as memory for the regenerator 60, the transmitted data words (20 bits) must be separated by a sufficient delay to avoid corrupting signals on the data link. Col. 5 l. 54 - col. 6 l. 3 ("In the preferred embodiment, a phase-encoded data word is 1000 nanoseconds (billionths of a second) long. Lines 16a and 14a (FIG. 1) are each 200 feet long and the velocity of propagation over these lines is 1.6 nanoseconds/foot.

Lines 14a and 16a, therefore, require a pulse travel time of (400 feet x 1.6 nanoseconds/foot) = 640 nanoseconds. The desired gap or dead space between consecutive data words is about one fourth the word length or 250 nanoseconds. Hence, the delay line 29 (FIG. 2) is adjusted for a delay time given by $D = L + S - T$, where L is the length of the phase encoded data word, S is the desired word separation and T is the sum of the travel times of a pulse through lines 14a and 16a. As a numerical example, the artificial delay D is $D = (1000 + 250 - 640) = 610$ nanoseconds."). For example, when transmitting initial elemental seismic sensor data stored in storage register 58, when a signal simultaneously arrives at data link 14b (Figure 3), the two discrete signals are combined into one corrupted signal by the digital logic OR gate 102. Therefore it is necessary to ensure ample delay between data words, thus sacrificing data transmission throughput. Timing is critical, and a failure in a delay network 29 (Figure 2) may cause complete corruption of the data or the seismic system to become inoperable.

In contrast, the present invention eliminates delay overhead by using multi-bit memory 28′ and a processor to allow simultaneous and independent reception and transmission of data at each sensor pod. The memory 28′ has sufficient capacity to store the entire amount of data collected from the sensors, capacity to store incoming data from an adjacent device, plus capacity ti support operation of the processor 120. The combination of multi-bit memory and bucket brigade communication in seismic arrays is believed to be novel and unobvious. Neither Zimmer nor Siems discloses or suggests the use of multi-bit memory used to enhance bucket brigade data transfer.

Where the references taken together fail to disclose all of the limitations in the claim, a prima facie case of obviousness is not shown. As Siems combined with Zimmer fails to disclose

or suggest the elements of independent claims 20, 96 and 113 as amended herein, a section 103 rejection is now improper as to these claims and all the claims dependant thereon.

Claims 22, 24, 98 and 99 are amended to replace functional language with equivalent structural language. Claim 23 is cancelled.

In summary, claims 20-22, 24-74 and 96-113 remain in the application and, as amended, are believed to be novel, patentably distinct and in condition for allowance. Allowance and passage to issue is respectfully requested.

Respectfully submitted,

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